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IV
VOLUME ~~III~~ JANUARY-MARCH, 1929 No. 1

JOURNAL

OF THE

Pan-Pacific Research Institution

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At the Pan-Pacific Institution

The work at the Pan-Pacific Institution is developing along a number of lines. Scientists from America and other Pacific lands continue to occupy its guest house while pursuing botanical research work in Hawaii. There are a few resident science workers, and the house for Junior scientists attending science courses at the University of Hawaii is filling up. At present China, Japan, America and Siam are represented by student residents.

Science dinners are held in the main building almost nightly. The research workers of the Pan-Pacific Women's Conference meet and dine here together on Tuesdays, the scientists interested in calling the Second Pan-Pacific Food Conservation Conference hold their dinner meetings here on Wednesdays, the regular popular science suppers on Friday evenings, and the Junior Scientists began two years ago holding their dinner meets on Saturday evenings.

After the popular science suppers on Friday nights at the Pan-Pacific Research Institution, illustrated lectures are given and the Junior Scientists are planning their series of Saturday night popular science lectures.

The Junior Architects are remodeling one of the buildings as a lecture hall, where they will hold their meetings and where the regular science lectures will be held.

The editorial board of the "Journal of the Pan-Pacific Research Institution" is still gathering data on the fish of the Pacific and under the guidance of Dr. David Starr Jordan, president of the Institution, the check list of the Fish of the Pacific is being published, first in the Journal, the type being held for book publication when the check list is completed.

It is possible now to send for correction the proof sheets of papers to be published in the quarterly science number of the Mid-Pacific Magazine to the authors in different Pacific lands. While the board of editors of the Journal of the Pan-Pacific Research Institution are in no way responsible for this quarterly edition of the magazine, they glady cooperate in securing for it the popular science papers read or prepared as lectures at the Institution. In this way lectures given by some of the most distinguished scientists of Pacific lands, visiting Hawaii, find their way into print and are of use to students.

Scientists interested in food and population problems of the Pacific are invited as guests at the Pan-Pacific Research Institution during their research work in Hawaii.

The Junior Scientists at the Institute have accumulated a valuable equipment of machinery for the work of promoting visual education; cameras, movie machines, microscopes, microphotographic instruments, projection machines of several kinds; for both motion and still pictures. All of these they are learning to use and are beginning to turn out standard sized film pictures of scientific and educational subjects. They have access to a library of some ten thousand photographs from Pacific lands; for these they are printing captions and descriptions. then reproducing the whole on strips of film for distribution to educational institutions. For their use the Pan-Pacific Union asks for pictures of educational value from every Pacific land.

The Junior Scientists have been placed in charge of the mosquito survey in Honolulu, and their elders, among the older scientists, believe they now see a way to eradicate the mosquito in the city.

The Pan-Pacific Science Council workers are still interested in the plans for a Pan-Pacific Botanic Garden and they are now preparing the tentative agenda for the Second Pan-Pacific Food Conservation Conference to gather in Honolulu during August, 1931.

A Check List of Fishes Recorded from Russian Pacific Waters

By V. K. SOLDATOV,
Academy of Agriculture, Moscow

In the following list are enumerated the families, genera, and species of fishes inhabiting the Russian Pacific waters: the Possiet Bay, Peter the Great Bay, Gulf of Tartary, Okhotsk Sea along the coast of Siberia northward to the coast of Kamchatka.

In the list are included some of the fresh water fishes, entering the brackish waters or inhabiting the rivers near to their mouths.

The list is not presumed to be complete, since large collections of fishes, made by the expedition of the Department of Agriculture in the years 1906-1916, those of the North Pacific Hydrographical Expedition and very interesting new collections of the Pacific Biological Station at Vladivostok are not yet described and without doubt contain many unrecorded fishes. The fish fauna of the deep sea in our waters is yet to be made known and a very interesting phenomenon of the continuous penetrating of fishes in our waters from the south was observed during last year by the investigators of the Biological Station at Vladivostok and others. Therefore, to the marine species enumerated I suppose some other new ones should have probably been added.

The first systematic catalogue of fishes known from Russian Pacific waters is contained in the great work of Peter Schmidt: "Pisces Marium Orientalium Imperii Rossici," published at St. Petersburg, 1904, by the Russian Geographical Society.

Since the publications of the monograph of Peter Schmidt, the young ichthyologist M. N. Pavlenko (now deceased), described in 1907 the fishes of Peter the Great Bay. Subsequently fishes from different parts of Okhotsk Sea were described by Prof. L. S. Berg, P. J. Schmidt, V. K. Soldatov, M. N. Pavlenko, G. U. Lindberg and others.

In the present list all these records are brought together to the date of February, 1928.

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Family I. PETROMYZONIDAE

1. Lampetra fluviatilis japonica Martens.

Family II. SQUALIDAE

2. Squalus acanthias Linnaeus.

Family III. CARCHARIIDAE

3. Mustelus mustelus manazo Bleeker.
4. Triakis scyllium Muller and Henle.*

Family IV. SPHYRNIDAE

5. Sphyrna zygaena (Linnaeus).

Family V. DALATIIDAE

6. Somniosus microcephalus (Bloch).

Family VI. LAMNIDAE

7. Lamna cornubica (Gmelin).

Family VII. RAJIDAE

8. Raja binoculata Girard.
9. Raja kenojei Muller and Henle.
10. Raja parmifera Bean.
11. Raja aleutica Gilbert.
12. Raja roseispinis Gill and Townsend.
13. Raja interrupta Gill and Townsend.
14. Raja smirnovi Soldatov and Pavlenko.

Family VIII. DASYATIDAE

15. Dasyatis akajei (Müller and Henle).
16. Urolophus giganteus Lindberg.

Family IX. ACIPENSERIDAE

17. Huso dauricus (Georgi).
18. Acipenser schrenki (Brandt).
19. Acipenser medirostris Ayres.

Family X. CLUPEIDAE

20. Clupea harengus pallasii (Cuv. & Val.).
21. Harengula zunasi (Bleeker).
22. Sardinella melanosticta (Temminck and Schlegel).

Family XI. ENGRAULIDAE

23. Engraulis japonicus Temminck and Schlegel.

Family XII. DOROSOMATIDAE

24. Clupanadon punctatus (Temminck and Schlegel).

Family XIII. SALMONIDAE

25. Salmo mykiss Walbaum.
26. Oncorhynchus masu Brevoort.
27. Oncorhynchus kisutch (Walb.).
28. Oncorhynchus keta (Walb.).
29. Oncorhynchus gorbuscha (Walb.).
30. Oncorhynchus nerka (Walb.).
31. Oncorhynchus tschawytscha (Walb.).
32. Salvelinus alpinus malma (Walb.).
33. Salvelinus leucomaenis (Pallas).
34. Hucho perryi (Brevoort).
35. Brachymystax lenok (Pallas).
36. Coregonus ussuriensis Berg.
37. Coregonus chadary Dybowski.
38. Thymallus arcticus grubei Dybowski.

Family XIV. OSMERIDAE

39. Osmerus eperlanus dentex Steindachner.
40. Mesopus olidus (Pallas).

Family XV. SALANGIDAE

41. Salangichthys microdon Bleeker.

Family XVI. CYPRINIDAE

42. Leuciscus brandti (Dybowski).
43. Leuciscus waleckii (Dybowski).

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* Probably a new species.

44. Phoxinus percnurus mantschuricus Berg.
45. Phoxinus percnurus sachalinensis Berg.
46. Phoxinus lagowskii Dybowski.
47. Phoxinus lagowskii variegatus (Günther).
48. Pseudaspius leptocephalus (Pallas).
49. Gobio gobio (Linnaeus).
50. Hemibarbus labeo (Pallas).
51. Hemibarbus labeo maculatus Bleeker.
52. Parabramis pekinensis (Basilewski).
53. Culter erythropterus Basilewsky.
54. Culter mongolicus Basilewsky.
55. Carassius carassius (Linnaeus).
56. Cyprinus carpio Linnaeus.
57. Hypophthalmichthys molitrix (Valenciennes).

Family XVII. COBITIDAE

58. Nemachilus barbatulus toni (Dybowski).
59. Misgurnus fossilis anguillicaudatus (Cantor).
60. Cobitis taenia Linnaeus.

Family XVIII. SILURIDAE

61. Parasilurus asotus (Linnaeus).

Family XIX. BAGRIDAE

62. Pelteobagrus fulvi-draco (Richardson).
63. Liocassis brashnikovi Berg.

Family XX. ESOCIDAE

64. Esox reicherti Dybowski.

Family XXI. HEMIRHAMPHIDAE

65. Hyporhamphus sajori (Temminck and Schlegel).

Family XXII. SCOMBRESOCIDAE

66. Cololabis saira (Brevoort).

Family XXIII. BELONIDAE

67. Tylosurus anastomella (Cuvier and Valenciennes).

Family XXIV. MUGILIDAE

68. Mugil haematochilus Temminck and Schlegel.

Family XXV. SCOMBRIDAE

69. Pneumatophorus japonicus Houttuyn.
70. Auxis thazard (Lacepede).
71. Thunnus thynnus (Linnaeus).
72. Scomberomorus niphonius Cuvier and Valenciennes.

Family XXVI. TRICHIURIDAE

73. Trichiurus japonicus (Temminck and Schlegel).

Family XXVII. CARANGIDAE

74. Seriola aureovittata Temminck and Schlegel.
75. Trachurus japonicus (Temminck and Schlegel).

Family XXVIII. PRIACANTIDAE

76. Priacanthus japonicus Cuvier and Valenciennes.

Family XXIX. STROMATEIDAE

77. Reprilus paru (L.).

Family XXX. SERRANIDAE

78. Lateolabrax japonicus (Cuvier and Valenciennes).

Family XXXI. SPARIDAE

79. Sparus swinhonis czerskii Berg.

Family XXXII. MONACANTHIDAE

80. Cantherines modestus (Günther).

Family XXXIII. TETRAODONTIDAE

81. Spheroides rubripes (Temminck and Schlegel).
82. Spheroides borealis Jordan and Snyder.
83. Spheroides niphobles Jordan and Snyder.
84. Spheroides pardalis (Temminck and Schlegel).

Family XXIV. SCORPAENIDAE

85. Sebastodes glaucus (Hilgendorf).
86. Sebastodes schlegeli (Hilgendorf).
87. Sebastodes ciliatus (Tilesius).
88. Sebastodes ruber Pavlenko.
89. Sebastichthys trivittatus (Hilgendorf).

Family XXXV. HEXAGRAMMIDAE

90. Hexagrammus octogrammus (Pallas).
91. Hexagrammus stelleri Tilesius.
92. Hexagrammus lagocephalus (Pallas).
93. Pleurogrammus monopterygius (Pallas).

Family XXXVI. COTTIDAE

94. Icelus spiniger Gilbert.
95. Icelus uncinatus Gilbert and Burke.
96. Icelus spatula Gilbert and Burke.
97. Icelus ochotensis Schmidt.
98. Ochotskia armata Schmidt.
99. Artediellus ochotensis Gilbert and Burke.
100. Artediellus camchaticus Gilbert and Burke.
101. Artediellus aporosus Soldatov.
102. Artediellus dydymovi Soldatov.
103. Artediellus schmidti Soldatov.
104. Artedielloides auriculatus Soldatov.
105. Triglops beani Gilbert.
106. Triglops jordani (Schmidt).
107. Triglops macellus (Bean).
108. Triglops scepticus (Gilbert).
109. Stegistrum stejnegeri Jordan and Gilbert.
110. Hemilepidotus hemilepidotus Tilesius.
111. Hemilepidotus jordani Bean.
112. Hemilepidotus gilberti Jordan and Starks.
113. Melletes papilio Bean.
114. Ceratocottus diceraus (Pallas).
115. Ceratocottus namiyei Jordan and Starks.
116. Dasycottus setiger Bean.
117. Cottus poecilopus Heckel.
118. Cottus amblystomopsis Schmidt.
119. Cottus paltschevskii Schmidt.
120. Cottus czerskii Berg.
121. Mesocottus haitej Dybowski.
122. Myoxocephalus quadricornis (Linnaeus).
123. Myoxocephalus jaok (C. and V.).
124. Myoxocephalus polyacanthocephalus (Pallas).
125. Myoxocephalus stelleri Tilesius.
126. Myoxocephalus tuberculatus Soldatov and Pavlenko.
127. Myoxocephalus nivosus (Herzenstein).
128. Myoxocephalus raninus Jordan and Starks.
129. Myoxocephalus brandti Steindachner.
130. Myoxocephalus ensiger (Jordan and Starks).
131. Myoxocephalus (Porocottus) sellaris (Gilbert).
132. Megalocottus platycephalus (Pallas).

133. Taurocottus bergii Soldatov and Pavlenko.
134. Trichocottus brashnikovi Soldatov and Pavlenko.
135. Malacocottus zonurus Bean.
136. Eurymen gyrinus Gilbert and Burke.
137. Gilbertidia ochotensis Schmidt.
138. Phychrolutes paradoxus Günther.
139. Argyrocottus zanderi Herzenstein.
140. Gymnocanthus pistilliger (Pallas).
141. Gymnocanthus intermedius (Temminck and Schlegel).
142. Gymnocanthus galeatus herzensteini Jordan and Starks.
143. Gymnocanthus galeatus detrusus Gilbert and Burke.
144. Cottiusculus gonez Schmidt.
145. Crossias allisi Jordan and Starks.
146. Crossias beringi Soldatov.
147. Elapichthys elongatus (Steindachner).
148. Alcichthys alcicornis (Herzenstein).
149. Bero elegans (Steindachner).
150. Histiocottus bilobus (Cuvier and Valenciennes).
151. Blepsias draciscus Jordan and Starks.
152. Nautiscus pribilovius (Jordan and Gilbert).
153. Hemitripterus villosus (Pallas).

Family XXXVII. AGONIDAE

154. Tilesina gibbosa Schmidt.
155. Percis japonicus Pallas.
156. Agonomalus proboscidalis Valenciennes.
157. Agonomalus jordani Schmidt.
158. Agonomalus brashnikovi Pavlenko.
159. Hypsagonus quadricornis C. and V.
160. Occa dodecaedron (Tilesius).
161. Brachyopsis rostratus (Tilesius).
162. Pallasina barbata (Steindachner).
163. Podothecus gilberti (Collet).
164. Podothecus thompsoni Jordan and Gilbert.
165. Podothecus accipiter Jordan and Starks.
166. Podothecus veternus Jordan and Starks
167. Sarritor frenatus Gilbert.
168. Sarritor leptorhynchus Gilbert.
169. Aspidophoroides bartoni Gilbert.
170. Anoplagonus inermis (Günther).

Family XXXVIII. CYCLOPTERIDAE

171. Cyclopterichthys ventricosus Pallas.
172. Eumicrotremus orbis (Günther).
173. Eumicrotremus pacificus Schmidt.
174. Eumicrotremus brashnikovi Schmidt.

Family XXXIX. LIPARIDIDAE

175. Liparis pulchellus Aures.
176. Liparis ochotensis Schmidt.
177. Liparis agassizii Putnam.
178. Liparis owstoni (Jordan and Snyder).
179. Neoliparis grebnitzkii Schmidt.
180. Careproctus mederi Schmidt.
181. Careproctus acanthodes Gilbert and Burke.
182. Careproctus trachysoma Gilbert and Burke.
183. Careproctus entargyreus Gilbert and Burke.
184. Crystallias matsusimae Jordan and Snyder.

Family XL. ELEOTRIDAE

185. Percottus gleni Dybowski.

Family XLI. GOBIIDAE

186. Rhinogobius hadropterus (Jordan and Snyder).
187. Chaenogobius macrognathos (Bleeker).
188. Tridentiger obscurus (Schlegel).
189. Chloea aino Schmidt.

Family XLII. BATHYMASTERIDAE

190. Bathymaster signatus Cope.

Family XLIII. TRICHODONTIDAE

191. Arctoscopus japonicus (Steindachner).

Family XLIV. BLENNIIDAE

192. Bryostemma polyastocephalum (Pallas).
193. Enedrias nebulosus (Temminck and Schlegel).
194. Pholis pictus (Kner).
195. Pholis dolichogaster (Pallas).
196. Pholis taczanowskii (Steindachner).
197. Pholis ornatus (Girard).
198. Pholis fasciatus (Bloch & Schneider).
199. Alectrias alectrolophus (Pallas).
200. Neozoarces pulcher Steindachner.
201. Neozoarces steindachneri Jordan and Snyder.
202. Opisthocentrus ocellatus (Tilesius).
203. Opisthocentrus zonope Jordan and Snyder.
204. Kasatkia memorabilis Soldatov and Pavlenko.
205. Abryois azumae Jordan and Snyder.
206. Pholidapus dybowski (Steindachier).
207. Askoldia variegata Pavlenko.
208. Askoldia variegata knipowitschi Soldatov.
209. Ernogramnus enneagrammus (Kner).
210. Ernogrammus hexagrammus (Temminck and Schlegel).
211. Ernogrammus epallax Jordan and Snyder.
212. Ernogrammus storoshi Schmidt.
213. Ozorthe nevelskoi Schmidt.
214. Stichaeus punctatus (Fabricius).
215. Stichaeus nozawae Jordan and Snyder.
216. Stichaeopsis nana Kner and Steindachner.
217. Dinogunellus grigorjewi (Herzenstein).
218. Lumpenus anguillaris (Pallas).
219. Lumpenus fowleri Jordan and Starks.
220. Lumpenus medius Reinhardt.
221. Lumpenopsis pavlenkoi Soldatov.

Family XLV. ANARHICHADIDAE

222. Anarhichas lepturus Bean.

Family XLVI. ZOARCIDAE

223. Zoarces elongatus Kner.
224. Krusensterniella notabilis Schmidt.
225. Krusensterniella multispinosa Soldatov.
226. Lycodes heinemanni Soldatov.
227. Lycodes brashnikovi Soldatov.
228. Lycodes schmidti Soldatov.
229. Lycenchelys brachyrhynchus Schmidt.
230. Lycenchelys fasciatus Schmidt.
231. Lycenchelys lacertinus Pavlenko.
232. Lycenchelys ornatus Soldatov.
233. Hadropareia middendorfii Schmidt.
234. Gymnelis viridis Fabriciris.

235. Gymnelopsis ocellatus Soldatov.
236. Gymnelopsis brashnikovi Soldatov.
237. Lycogrammoides schmidti Soldatov and Lindberg.

Family XLVII. AMMODYTIDAE

238. Ammodytes personatus Girard.
239. Hypoptychus dybowskii Steindachner.

Family XLVIII. GADIDAE

240. Boreogadus saida (Lepechin).
241. Theragra chalcogramma (Pallas).
242. Gadus morrhua macrocephalus (Tilesius).
243. Eleginus navaga gracilis (Tilesius).
244. Lota lota L.

Family XLIX. PLEURONECTIDAE

245. Hippoglossus stenolepis Schmidt.
246. Hippoglossoides elassodon dubius Schmidt.
247. Hippoglossoides elassodon robustus (Gill & Townsend).
248. Hippoglossoides elassodon elassodon (Jordan and Gilbert).
249. Protopsetta herzensteini (Schmidt).
250. Acanthopsetta nadeshnyi Schmidt.
251. Verasper variegatus (Temminck and Schlegel).
252. Lepidopsetta bilineata (Ayres).
253. Limanda angustirostris Kitahara.
254. Limanda schrenki Schmidt.
255. Limanda yokohamae (Günther).
256. Limanda iridorum Jordan and Starks.
257. Limanda aspera (Pallas).
258. Limanda proboscidea Jordan and Gilbert.
259. Pleuronectes quadrituberculatus Pallas.
260. Liopsetta pinnifasciata (Kner).
261. Liopsetta obscura (Herzenstein).
262. Liopsetta glacialis Pallas.
263. Platichthys stellatus (Pallas).
264. Microstomus stelleri Schmidt.
265. Glyptocephalus ostroumovi Pavlenko.
266. Kareius bicoloratus Basilewski.

Family L. SOLEIDAE

267. Symphurus orientalis (Bleeker).

Family LI. SYNGNATHIDAE

268. Syngnathus schlegeli Kaup.
269. Hippocampus japonicus Kaup.

Family LII. GASTEROSTEIDAE

270. Gasterosteus aculeatus Linnaeus).
271. Pungitius pungitius (Linnaeus).
272. Pungitius sinensis (Guichenot).
273. Pungitius tymensis (Nikolsky).

In the list of fishes are not included the following fishes which were recorded for our waters: (1) *Myoxocephalus axillaris* (Gill), recorded erroneously from brackish waters of the Amur Estuary as *Myoxocephalus axillaris* (Gill); on the basis of specimens of *Megalocottus platycephalus* with the somewhat shorter lower jaws. (2) *Porocottus nigrescens* Tanaka and *Porocottus ijimai* Tanaka both based on specimens of *Megalocottus platycephalus* in the spawning dress. (3) *Porocottus tentaculatus* Kner: the fishes recorded in the Russian ichthyological literature as *Porocottus tentaculatus* Kner belong to another genus (*Crossias*) and among numerous collections of fishes from Russian Pacific waters I could not find any specimens of *Porocottus tentaculatus* Kner.

V. K. Soldatov.

A California Big Tree at the University of Amoy

Through the courtesy of Professor E. D. Merrill, Dean of the College of Agriculture, University of California, and Colonel John R. White, Superintendent of the Sequoia National Park, California, a section of Sequoia gigantea, the so-called Big Tree of California, has been donated by the latter gentleman to the Department of Botany of the University of Amoy for display in its Museum of Economic Botany. So far as known, this is the first section of this world famous tree to be brought to China for educational purposes.

According to Colonel White, the tree from which this section was cut fell in 1915. At that time the age was estimated as 1995 years. That means, this was already a sturdy tree when Christ was born.

This section has a diameter of 9 feet 10 inches and a thickness of 10 inches. It is now placed on exhibition at the entrance to the Biology building of the University of Amoy. Colonel White has also kindly promised to send specimens of the bark, foliage, cones and seeds as well as photographs of groves of standing trees as they appear in the forest to be exhibited along side with the wood section, thus giving a complete story of the tree.

World Engineering Congress in Tokyo

October, 1929

1. **General Problems Concerning Engineering:** Education, Administration, Statistics, Standardization, International Cooperation of Engineers, etc.

2. **Engineering Science:** Strength of Materials, Thermodynamics, Hydraulics, Electricity and Magnetism, and other Scientific Researches.

3. **Precision Machines and Instruments.**

4. **Architecture and Structural Engineering:** Architectural Designing, Development of Modern Architecture, Preservation of National Memorials, Housing Problems, Bridge Engineering, Fire Protection, Earthquake-Proof Construction, Framed Structure, Masonry Construction, Reinforced-Concrete Construction, Earth Problem, Mechanical and Electric Equipments of Buildings.

5. **Public Works:** Harbour Engineering, River Engineering, Canals, Highways, Irrigation, Waterworks, Sewages, City Planning, etc.

6. **Railway Engineering:** Location, Construction, Operation, Rolling Stocks, Machinery, Signalling and Safety Appliances, Electrification, Street Railway.

7. **Transportation:** Land, Water and Aerial Transportation.

8. **Communication:** Telegraph, Telephone, Wireless Telegraph and Telephone, Radio Broadcasting.

9. **Power:** Resources, Waterpower Plant, Steampower Plant, Utilization of Natural Steam, Tidal Power, Transmission and Distribution, etc.

10. **Electrical Engineering:** Generators and Motors, Transformers and Converters, Measuring Instruments, Electric Switch Gears, Power Cables, Vacuum Tubes, Electrical Heating Appliances.

11. **Illuminating Engineering:** Electric Lamps, Illumination, etc.

12. **Mechanical Engineering:** Heat Engines and Boilers, Hydraulic Machinery, Pneumatic Machinery, Machine Tools and Machines for Manufacturing, Machines for Conveyance, Ordnance, Mechanism and Machine Design, Heating and Ventilation, etc.

13. **Refrigerating Industry:** Refrigerating Plants, Insulation, Cold Storage, Ice-Making Industry, Transportation of Refrigerated Goods, Refrigeration in Chemical Industry, Agriculture, Hygiene.

14. **Textile Industry:** Textile Raw Materials, General Spinning, Silk Throwing, Rayon Spinning, Weaving, Knitting, Textile Finishing, Textile Machinery, Mill Management, etc.

15. **Shipbuilding and Marine Engineering:** Theoretical Naval Architecture, Construction of Ships, Governmental and Classification Society's Regulation Rules for Shipbuilding and Marine Engineering, Main and Auxiliary Machinery, Equipments of Shipbuilding Yards, Ship Equipments, Life-Saving Appliances, etc.

16. **Aeronautical Engineering:** Aerodynamics, Aeroplanes, Dirigibles, Air Propellers, Equipments, Instruments.

17. **Automotive Engineering:** Chassis, Bodies, Automotive Engines, Motor Car Equipments, etc.

18. **Chemical Industry:** Acid and Alkali Industry, Artificial Fertilizer and Fixed Nitrogen, Electrochemical Industry, Compressed and Liquified Gas Industry, Ceramics, Explosives and Coal Tar Products, Cellulose Industry (Paper, Celluloid, Artificial Silk), Sugar Industry, Brewing and Alcoholic Industry, Fat and Soap, Paint and Varnish, Rubber Industry, etc.

19. **Fuel and Combustion Engineering:** Solid, Liquid and Gaseous Fuels and their Appliances.

20. **Mining and Metallurgy:** Economic Geology, Mining (Ores, Coal and Petroleum), Dressing, Iron and Steel, Metal and Alloys, Mechanical Technology, etc. 21. **Engineering Materials.** 22. **Scientific Management.** 23. **Miscellaneous.**

Some Problems Relating to a Botanical Survey and Ways in which the Botanical Society May Aid in Their Solution[1]

HERBERT F. BERGMAN.

The need of a complete, thorough botanical survey of a region would no doubt be granted by every botanist within the region concerned. The first and fundamental work of a botanical survey is the classification of the plants of the region. This has been done, in a large measure, for the Hawaiian Islands, by Hillebrand in his highly valuable "Flora of the Hawaiian Islands" (6). The work of Hillebrand has been supplemented by the more recent publications of Rock on "Indigenous Trees of Hawaii" (12), "Monograph of the Lobeliodeae" (13), "Cytrandreae Hawaiiensis" (14, 15, 16, 17), and several lesser contributions. Beccari and Rock's "Monograph of the Genus Pritchardia" (1), Hitchcock's "Grasses of Hawaii" (7), and several lesser contributions of other workers. Undoubtedly, new species will yet be discovered, but the work of exploration has progressed so far that the discovery and description of new species must now be regarded as a minor part of future work.

With due appreciation of the valuable foundational work of Hillebrand and the excellent contributions of Rock, it must be said that their publications do not complete the work of the classification of the plants of the Islands, and even after the classification is completed many other problems remain to be attacked. Although the work of Hillebrand and Rock may be complete and accurate in many cases, and hence final, there are groups in which the classification is obviously incomplete, inaccurate, and inconsistent. In these groups there is need of further, more careful study and of revision.

The purpose of taxonomy is to provide a true classification, to determine the actual status of individuals, and to assign these to species based on natural, fundamental differences. This can be accomplished only by having a classification in which the units are based upon a definite concept which may be analyzed and tested by observation and experiment instead of being left to the judgment or preference of some individual. Methods of classification have long been subject to controversy. It has been repeatedly pointed out by workers in various phases of botanical activity and of many different countries, that a classification based solely or primarily on herbarium specimens without adequate field study is usually quite unsatisfactory, and, especially in certain groups, tends to confusion rather than to clarification. This inadequacy of the ordinary taxonomic procedure centers about the lack of agreement as to what constitutes a species, and reveals itself not only in the necessarily incomplete analysis of polymorphic groups, but also in the more fundamental matters of the absence of clearly defined principles of procedure in the determination of species and in the inconsistency of the procedure adopted.

The work of Hillebrand, and of some other contributors to Hawaiian floristic botany, has been based primarily on the study of herbarium specimens. Because of the inherent impossibility of a complete and accurate analysis of polymorphic groups by the study of herbarium specimens unsupported by careful, extensive field work the treatment of certain groups by these authors is unsatisfactory. Mr. Rock's work on various groups of Hawaiian plants is based much more extensively on field studies than that of other botanists. In spite of a marked improvement in this respect he did not take into

[1] Address of the retiring president of the Hawaiian Botanical Society, December 5, 1927.

consideration the possible effects of hybridization in polymorphic groups, nor did he correlate diversity of form in such groups with known habitat conditions. It is with reference to problems involved in the analysis of various polymorphic groups, as well as of the matter of taxonomic procedure as a whole, and of ways in which members of this society may contribute to the solution of these problems, that I wish to direct your attention this evening. The number and the nature of the problems involved demands the active, earnest cooperation of many workers in various branches of botany and will require many years of persistent and painstaking effort for their solution. Nevertheless there seems to be no other method of reaching a satisfactory solution of the problems confronting us.

THE DISAGREEMENT ON THE CONCEPT OF THE SPECIES

The concept of a species varies greatly with individuals. The criteria used in the determination of a species may be indefinite or elastic resulting in the inclusion of an array of diverse forms as a single species. Such a species is variously designated as a Linnaean, aggregate or compound species or may be referred to in taxonomic descriptions as a "variable" species. Within such a species groups of relatively uniform and stable character may be recognized. On the other hand a species may be based on very slight differences discernable in herbarium specimens without regard to the reliability or constancy of these differences in the field. New species are too frequently founded on very inadequate specimens representing isolated collections, without supplementary data by the collector and entirely without field knowledge of the plant on the part of the taxonomist describing the species.

POLYMORPHY AND ITS CAUSES

In certain groups of plants one individual resembles any other individual so closely that there is no difficulty in recognizing their similarity or that they belong to a distinct race or group. In other cases a group may consist of two to many closely allied forms between which a great similarity exists but which also manifest more or less well defined differences. These differences are not all of the same rank or value and may be the result of any one of a number of factors or of combinations thereof. Differences of whatever rank or value may be considered under the term "polymorphy". Polymorphy may be defined as the existence of many forms or types of any member, e.g., leaves, of an individual plant or the existence of different forms or types of the members in plants in groups of related individuals, i.e., of the same variety or species.

Polymorphism may be due to a number of definite, recognizable causes or in other instances no cause can be assigned for its occurrence. Some of the more important of the definitely assignable causes are hybridism and response to environmental conditions. The latter may be included under a single term "epharmony". In addition to these may be added polymorphy due to heredity. The cause of hereditary differences is not apparent and it must be recognized that the expression of these hereditary differences may be modified by environmental conditions.

POLYMORPHY DUE TO HYBRIDISM

The extent to which hybridism occurs in nature has in the past not been appreciated fully. Natural hybrids have long been known to occur, but the frequency of the occurrence and the importance of hybridism in connection with taxonomic studies has not been recognized. Within the last decade or so, however, a realization of the prevalence of hybrids in nature and of the importance of natural hybridism with reference to the species concept has come about. The multiplicity of forms in the genus *Rosa* in the west European area has been attributed by Täckholm (19), and by Blackburn and

Harrison (2), to the frequency of occurrence of hybridism. Longley (10) has come to the same conclusion as a result of the study of the genus *Crataegus* in America. Hybridism has been found to be common not only in *Crataegus,* but also in all the larger genera of the Rosaceae and in many other families. Brainerd (4) has described many hybrids among the violets.

Cockayne and Allen (5) as a result of a study with reference to hybridism in New Zealand plants, have found that out of 125 genera, with 2-5 species, 42 species or 34% possess hybrids; in genera with 6-10 species, of 33 examined, 17 species, or 52% were found to possess hybrids; of 15 genera, with 11-20 species, 13 species, or 87% possess hybrids; and in 16 genera, with over 20 species, all of the species possess hybrids.

Jeffrey (9, p. 458) in referring to a recent address by Osborn (11), on evolution, states that isolated species "are in general distinguished by the fact that they do not intergrade with their more nearly related species". Jeffrey attributes this to the absence of the possibility of hybridism. He also says, "On the other hand, where species grow in proximity, they may naturally be connected with every possible sort of hybrid intergradation."

Mutation, as a method of origin of species, has received much attention since the time of DeVries. Classical examples of mutation are the evening primrose (*Oenothera*) and the fruit fly (*Drosophila melanogaster*). Jeffrey (9, p. 461) after a brief statement of experimental and cytological evidence indicating a hybrid origin of the mutating forms of these organisms states that "There can scarcely be any reasonable doubt that so-called mutation in general is associated with previous hybridization."

Another factor involved in a floristic study of any area is the possibility of the occurrence of parthenogenesis. This phenomenon is known to occur in species of *Antennaria, Hieracium* and *Alchemilla* and possibly occurs in other genera. Jeffrey (l.c.) after a study of the cytological behavior of parthenogenetic species comes to the conclusion that "On the basis of detailed agreement in essential features with known hybrids, there seems to be no reasonable doubt that parthenogenesis in plants may be a favorable variation following previous hybridization".

In view of the evidence presented the probability of the occurrence of hybridism in many genera of Hawaiian plants, and the importance of taking hybridism, and its associated phenomenon of parthenogenesis, into consideration in a floristic study of the Hawaiian area becomes obvious.

HYBRIDISM IN HAWAIIAN PLANTS

A few genera in which hybridism is to be expected may now be indicated. An examination of Hillebrand's Manual indicates that hybridism occurs in the genus *Sida* of the Malvaceae. Under *Sida fallax,* after the description of the species, Hillebrand describes two varieties. With reference to the secondary variety Hillebrand says: "A variety really much resembling *S. rotundifolia* Cav. and not separable by good characters from the following species, (*S. cordifolia L.*)." Referring to *S. cordifolia L.,* Hillebrand says: "Generally associated with *S. fallax* and *S. rotundifolia.* The three species seem to pass into each other where they occur together." The admitted existence of intergrading forms connecting *S. fallax* with *S. cordifolia* and *S. rotundifolia* is very strong presumptive evidence of hybridism between at least two species and possibly among several related species. The actual number of the species involved can not be determined without careful study.

In the genus *Kadua* (Rubiaceae) Hillebrand finds forms intermediate between *K. glomerata* and *K. centranthoides.* Under the description of the latter he states that the two species "cannot always be

strictly separated". The integrading forms are probably due to hybridism.

The numerous forms of the species (?) described by Hillebrand under the name *Metrosideros polymorpha* and in Rock's revision of the genus under the name *M. collina,* var. *polymorpha* (13) is an outstanding example of diversity or polymorphism within a group of related forms. Mr. Rock's revision is a very scholarly and helpful attempt to disentangle a puzzling array of forms and to arrange them according to their relationship. Mr. Rock himself does not claim that his classification of the various forms in the group is final. Whatever subsequent investigation may reveal as to the accuracy of his judgment in classification, it must be recognized that in his revision of the group a serious and praiseworthy effort has been made to properly correlate the many existing forms in a group of extreme diversity. Of it he says: "Hybridization has probably been the main factor next to location and environment, in producing these varieties." It is to be regretted that he did not attempt to relate the various forms to environmental conditions or to establish the existence of hybridism and the effect of hybridism on the diversity of forms in the group and thus put the classification on a secure basis.

Many other genera might be named as possible loci of hybridism but an extended citation of examples is hardly desirable. Any genus with five or more species may be expected to show hybridism between two or more species and should be critically examined for it.

EPHARMONY AS A CAUSE OF POLYMORPHY

The response to differences in the environment also causes much diversity in the character of individuals comprising a group. These habitat forms or epharmones may in some cases be quite distinct from the form commonly accepted as the "normal" and might in such instance be regarded as sufficiently distinct to constitute a "species". The confusion which this causes in taxonomic work has been pointed out by Turesson (20) and has been emphasized strongly by Cockayne and Allen (5). These habitat forms are inconstant as they are induced entirely by local habitat conditions and are capable of undergoing wide changes with change in the habitat conditions as was shown by the experiments of Bonnier (3). Turesson (20) in Sweden has, within recent years, carried on extensive experimental studies on the modification of plants by habitat conditions, and the relation of such response to the conception of the species. Cockayne and Allen in New Zealand for many years, have been engaged in the study of the response of plants to habitat conditions and the relation of epharmonic response and of other factors in relation to taxonomic conceptions. They have recently published (5) the data and conclusions reached as a result of their studies. The work of Turesson and particularly of Cockayne and Allen indicates the fundamental importance of giving due consideration to epharmonic response in any taxonomic study.

POLYMORPHY DUE TO EPHARMONIC RESPONSE IN HAWAIIAN PLANTS

The occurrence of polymorphism, in many groups of Hawaiian plants, as a result of response to environmental conditions is unquestionable. An outstanding example of diversity due to this cause is to be found in the genus *Metrosideros,* as is pointed out by Mr. Rock. Whether or not Mr. Rock's classification of this group is to stand remains to be determined by subsequent study. The group, however, should be subjected to a critical field study in order to place the classification on a secure and permanent basis.

Many other groups, particularly those of wide distribution so that they are brought within the influence of different environments may also be expected to exhibit polymorphism due to epharmony.

Genera such as *Gouldia, Kadua, Pelea* and *Bidens,* to mention only a few examples, are worthy of study with reference to this feature. Nearly all of the species of these genera have from two to several recognized varietal forms. Of course, it can not be determined, without careful study, whether such differences may be due to hybridism alone, to hybridism plus epharmony, or to the latter alone, but it is at least highly probably that response to environment is an important factor in the production of diversity in species of these genera and of numerous others.

THE CRITERIA OF A SPECIES

The absence of definite criteria by which a species may be recognized has, in the past, been the principal cause of the lack of agreement in the classification of polymorphic groups. Many definitions of the term "species" have been propounded but the interpretation of such definitions has always depended on the personal judgment and inclination of the taxonomist concerned. In order to reach a solution of taxonomic problems it is necessary to have criteria based upon objective characters so that personal judgment is eliminated. This has been attained apparently as a result of genetical and cytological investigations. Hurst (8) says: "In the light of recent experiments and researches in genetics, cytology and taxonomy it is now possible to present a more precise conception of a species. A species is a group of individuals of common descent with certain constant characteristics in common which are represented in the nucleus of each cell by constant and characteristic sets of chromosomes."

This definition seems to present the necessary preciseness and objectivity that criteria, in order to be acceptable to workers in various lines of botanical activity, should possess. Its application in the genus *Rosa* by Blackburn and Harrison (2), and by Hurst (8), has resulted in an orderly arrangement of the previously existing puzzling array of so-called species with their numerous hybrids, subspecies, varieties and forms. The taxonomic units proposed and used by Hurst and others are subject to experimental verification by four distinct methods, taxonomic, cytological, genetical, and ecological. The application of genetical, cytological and ecological methods to taxonomic problems offers, I believe, not only the most promising but the only promising line of attack in the solution of problems of classification of plants.

METHOD OF PROCEDURE AND HOW THE BOTANICAL SOCIETY MAY CONTRIBUTE

In making a study of the vegetation of an area with reference to polymorphy of any group as a result of hybridism, of epharmony or of some other unassigned cause, it is, first of all, necessary to determine the groups within which diversity of form occurs, and to ascertain the distribution of the various forms within the group.

It is in obtaining this information that members of the Botanical Society may be of much value. Specimens of plants should be taken from many different localities and under as diverse habitat conditions as possible. In collecting the specimens, the collector should first of all try to make sure that the specimen or specimens collected are representative. Flowers or fruits, or if possible, both, should be collected. Specimens should be taken from one plant only at a time and the collector should observe this plant carefully to ascertain whether or not there is any diversity in leaves, flowers or other parts of the individual from which specimens are taken. If diversity of form of any member of the plant body occurs within an individual plant specimens should be taken to represent such diversity. Each plant should be designated by a number or letter and each specimen taken from the plant should be marked with a tag giving the number or letter assigned to the plant. Specimens from an individual plant should be kept separate from specimens

from any other individual particularly of the same or related species. An accurate record of the locality and time of collection should be made. A description of the habitat conditions and of the plants associated with the individual from which the specimens are collected should accompany the locality record. In recording this information the number or letter by which the individual plant is designated should be clearly indicated so that there is no possibility of applying the data to any other individual than that to which it belongs.

If diversity of form occurs within a species it will soon become apparent from the specimens collected. At the same time a record of the distribution of the species and of the diversity and environmental conditions under which the plant grows will be indicated by the information accompanying the specimens.

When a polymorphic group is found attempts may be made to determine the cause of the diversity of form. Here again, members of the Botanical Society may give valuable assistance. As previously indicated polymorphy is generally brought about by hybridism, or epharmony or by a combination of the two. Evidence of hybridism could be secured by an examination of the pollen. It has been shown repeatedly that hybrid plants are characterized by showing a high percentage of sterile and abortive pollen grains. An examination of the pollen of a considerable number of plants of any polymorphic group would indicate the probable presence or absence of hybridism. The actual proof of hybridism and the percentage of the hybrids could, of course, be determined only by a genetic study. This should eventually be done in all cases where hybridism apparently occurs.

Along with this work a study should be made of the chromosome number of plants especially of genera in which several closely related species occur. The researches of Täckholm (19) of Blackburn and Harrison (2) and of Hurst (8) have shown the great utility of the determination of chromosome numbers in providing an objective conception of a species. It has been found in all cases examined that the number of chromosomes or chromosome sets is constant and characteristic for each species. In some cases all the species of a genus may have the same number of chromosomes. In a case of this kind a determination of the chromosome number would, in itself, be of very little value as a method of distinguishing species. In other cases different species of the same genus may have different chromosome numbers so that a chromosome count is a valuable basis of separation.

The prevalence of hybridism between groups of individuals depends not only on a community of range, either complete or partial, or at least on a contiguity of the areas occupied by these groups but also upon a community or an overlap of flowering period. It is obvious that hybridism would not occur between species, or groups, of widely separated range or between species, or groups with very different flowering periods.

With reference to the possibility of hybridism then, accurate information as to distribution and as to the time of flowering of species, especially those of large genera in which polymorphism is more apt to occur, should be available. Information on both of these points could be accumulated and recorded by the Botanical Society.

The mode of pollination of flowers is an important factor with reference to hybridism. The mode of pollination to which the various species are adapted; the location of plants of wind pollinated types with reference to each other and to the direction of the prevailing winds; the extent to which there is community of the flowering periods of closely related species or to which they overlap; the agents of pollination of insect pollinated flowers, the frequency of insect visitation; whether insects confine their visits to a single species or variety or if

they visit several species or varieties, growing in close proximity, indiscriminately; and the possibility of self pollination, are some of the points with which members who are entomologists might profitably direct some attention.

Another line of activity, in which the Botanical Society might well engage itself has to do with the occurrence and distribution of introduced plants. The extension of information along this line has no direct bearing on the problems previously suggested. Nevertheless the accumulation of such information is necessary if our knowledge with reference to plant life in the Islands is to be complete and accurate. Lists of introduced plants and additions thereto have been published from time to time by various organizations engaged in botanical work. It seems to me, however, that a centralization of this information and the compilation of a list of introduced plants, with as accurate a statement as possible as to the distribution of each plant, is very desirable and that the Botanical Society is the proper organization to undertake this task.

These problems provide opportunity for workers of varied interests and range in complexity from mere collection, carefully done, to problems requiring exacting, extensive and prolonged investigation. They provide opportunity not only for workers individually but also for cooperation in their solution. Will the opportunity be neglected?

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A Siberian Production Conference

In view of the calling of a second Pan-Pacific Food Conservation Conference to convene in Honolulu, August, 1931, the following communication from a member of the Pan-Pacific Science Council in Vladivostok, is of interest:

I attended the First Conference on the Russian Far East Production Problems. Supposing it may be of interest for the Pan-Pacific Union, I send you a short account of the conference and a list of reports given.

THE FIRST CONFERENCE ON RUSSIAN FAR EAST PRODUCTION PROBLEMS

The aim of the conference was to bring together Russian Far East Scientists for mutual information about scientific work in different kinds of Far Eastern knowledge, for discussion, which parts of the country and which branches of its industry are not explorated enough, and for planning next research work.

There were invited delegates from the Far Eastern University, Far Eastern Research Institute, Russian Geographical Society and its branches, Far Eastern scientific bodies, as the Vladivostok meteorological observatory, Pacific Hydrographic Expedition, Geological Committee of Russian Far East. Maritime agricultural Station, Pacific Biological Station, Veterenarian Experiment Institute and some government offices, carrying on research work, Foreign representatives—from China and Japan—were also invited.

The conference was held April 10-18 at Habarovsk. There were about 150 members and about 180 reports were proposed. Among the members of the conference not less than thirty were professors of high schools: the Leningrad academic center was represented by Professor Veinberg, the celebrated physician, who had visited Hawaii in 1919; Japan was represented by three professors and among them Professor Ogura, the member of National Research Council; China sent no delegates on account of the vigour of the strife there.

The conference had an opening session, two plenary sessions, commissions meetings, a session for adoption of resolutions and election of the Organization Research Bureau.

In the plenary sessions general reports were given. Contents were as follows:

1. The general economic policy of the Russian Far East.
2. The colonization in regard to the economic policy.
3. The plan of the colonization.
4. The population as a production factor.
5. The Russian population of the Far East.
6. The organization of research institutions in Europe, America and Russia.
7. The Research Institute of the State Far Eastern University.
8. Aims and organizations of geological survey on Russian Far East.
9. Results of botanic investigations.
10. Organization of agricultural research.
11. Plans of biological study of Pacific Seas.
12. Opportunities of the local forestry.

The conference was divided into six commissions where special reports were held. The commissions were as follows:

1. Surface, climate, mineral wealth.
2. Plants and forests.
3. Game, fishes, animal husbandry.
4. Population and health.
5. Trade and transportation.
6. Organization of research.

The Organization Research Bureau must print the works of the conference, plan the research activity of the different scientific bodies and prepare the next conference.